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Summary Report of

Utilization Research and Development

Fiscal year 1962

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**Agricultural Research Service
UNITED STATES DEPARTMENT OF AGRICULTURE**

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UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Research Service

SUMMARY REPORT OF UTILIZATION RESEARCH AND DEVELOPMENT

Fiscal Year 1962

I NATURE AND OPERATION OF UTILIZATION RESEARCH

The Department's utilization research investigations are conducted primarily in Federal facilities consisting of four regional laboratories and ten field stations in the United States. Research is done also through contracts and memoranda of understanding with State Experiment Stations, universities, and industry. Other supporting research is accomplished in research institutions of fourteen countries in Europe, Asia, and South America through funds generated by the P. L. 480 program (Agricultural Trade Development and Assistance Act of 1954, 83rd Congress, 2nd Session).

The aim of utilization research is to expand traditional outlets and to develop new industrial, food, and feed products and processes utilizing the products of American farms, particularly those in surplus. It achieves its objectives through basic research on the chemical, physical, and biological properties of farm products; developmental research on new processes and products; and engineering pilot-plant operations to adapt new laboratory products and processes to commercial practice.

Utilization research contributes to increasing farm income, to the establishment of rural industries, and to the variety and utility of products available to the consumer. It devises new, less costly, more attractive and more nutritious foods; it seeks significant new industrial uses, taking advantage of those built-in properties of agricultural products which cannot be had at lesser cost from petroleum, coal, or other raw materials; it shields the farmer's existing outlets in industry against invasion by synthetics. It is directed to expansion of all farm markets, foreign and domestic.

Utilization research is geared to the agriculture program of the '60's. It has and will continue to make effective contributions in three out of the four major problem areas cited in the Department's "Food and Agriculture: A Program for the 1960's" -- the problem of underconsumption; the problem of conservation and resource use; the problem of opportunities for farm and rural people.

II DISSEMINATING UTILIZATION RESEARCH INFORMATION

About 10,000 publications and more than 1,000 patents have emanated from the Utilization Research and Development program. The following statistics for F. Y. 1962 illustrate typical ways in which this information was disseminated for the public benefit:

<u>84</u>	patents obtained
<u>649</u>	research papers published
<u>685</u>	speeches, press releases, and appearances on radio and television
<u>63</u>	formal conferences with industry
<u>41</u>	public-service exhibits
<u>5,500</u>	technical visitors to UR&D laboratories

Illustrative examples are given below of how Utilization Research and Development research knowledge is made available to the public.

Federal Extension Service

Close collaboration is maintained with the Federal Extension Service of USDA as a means of disseminating Utilization Research information. At present there are positions in the UR Divisions for five FES representatives to assist in conducting technical liaison with processors, State and Federal Extension workers, and other groups to expedite adoption of UR-developed products, processes, and equipment. These FES people give specialized assistance in the fields of cereal grains, cotton fiber products, cotton processing equipment, fruits and vegetables (primarily potatoes), and dairy processes and waste disposal. These activities are fully coordinated to augment the liaison work done by the technical staffs of the UR&D laboratories.

Formal Conferences with Other Organizations

Conference on The Role of Wheat in the World's Food Supply--A conference on The Role of Wheat in the World's Food Supply was held at the Department's utilization research laboratory in Albany, California, on April 30 and May 1 and 2, 1962, with joint sponsorship of the National Association of Wheat Growers, Great Plains Wheat, Inc., Western Wheat Associates, Inc., and several interested agencies of the Department. The registered attendance of 243 included economists, nutritionists, marketing experts, and cereal scientists of international stature. Nearly 1,000 copies of the published "Proceedings" have been distributed to date.

Annual Corn Dry Milling Conference--The objectives of this conference, under the leadership of the Northern Utilization Research and Development Division, were to inform the corn dry milling industry of recent developments in the Department's utilization research program on corn and to obtain background on the industry's current needs and problems for use by Department scientists in planning and conducting research in this area. These objectives were achieved by presentation of papers by both Department scientists and industry spokesmen. The general discussion of presentations and problems emphasized the need for better characterization of corn before generally applicable improvements in processing can be made.

Seventh Technical Alfalfa Conference--The seventh annual Technical Alfalfa Conference of the American Dehydrators Association was co-sponsored by the Department's Western Utilization Research and Development Division at Albany, California, on July 27 and 28, 1961. The conference objective was to present reports of progress on research of interest to commercial forage dehydrators. Members of the Western Division and their cooperators in industry, in other Department agencies, and in the State experiment stations, made technical presentations to the 59 growers and processors attending.

Conference on Soybean Products for Protein in Human Foods--This conference was held, under the sponsorship of the Northern Utilization Research and Development Division, to review the increasing need for protein in world nutrition and to discuss the contribution that soybean food products can make to supply this need. Over a hundred people attended. An immediate effect of the conference on the Department's soybean utilization research program was initiation of cooperative studies with UNICEF on development of full-fat soybean flour for use in food products for foreign markets.

Cotton Utilization Research Meeting--The objective of this meeting, held in New Orleans at the Southern Utilization Research and Development Laboratory, on May 3-4, 1962, was to acquaint members of the textile industry with the newest developments in SU utilization research on cotton, and to develop ideas for other research needs. One hundred eighteen representatives of textile mills, finishing firms, chemical suppliers, and related research agencies, attended. This annual meeting affords a favorable occasion for rapid dissemination of SU's research on cotton. It encourages continued close cooperation between SU and members of the textile industry, and achieves an awareness by industry people of the potential benefits of Federal cotton utilization research in the expanded utilization of cotton.

Peanut Utilization Research Conference--A research conference was held at the Southern Utilization Research laboratory on January 15-16, 1962, with the objective to provide a review of progress in all utilization research on peanuts by various organizations, and to exchange information on research needs. There was an impressive representation, totaling 66, from various segments of the peanut industry, growers, shellers, manufacturers, UNICEF, and Rowett Institute of Edinburgh, Scotland.

Naval Stores Work Conference--The Southern Division sponsored a research conference in Jacksonville, Florida, on May 21-22, 1962, to discuss utilization research on naval stores by various organizations. The meeting, attended by 117 members of government and industry, provided an opportunity for the three groups--gum, wood, and sulfate naval stores producers and processors--to meet and to discuss items of common interest. The conference also gave a broader perspective to industry members of the potential benefits to be derived from Federal utilization research.

Twelfth National Potato Utilization Conference--The Twelfth National Potato Utilization Conference, held at Bakersfield, California, May 6 to 9, 1962, was organized by the Department's Western Utilization Research and Development Division and co-sponsored with the Potato Growers Association of California and Arizona, University of California, University of Arizona, Kern County Seed Potato Association, California Department of Agriculture, United Fresh Fruit and Vegetable Association, and other agencies of the Department. Approximately 125 potato growers, shippers, processors, and research and extension workers from State and Federal agencies throughout the United States and Canada attended. The purpose of these annual meetings is to make available results of current research pertaining to potato utilization, and to related aspects of production and marketing research.

Tobacco Chemists Research Conference--The 15th Tobacco Chemists Research Conference, held in Philadelphia, Pennsylvania, October 4-6, 1961, was attended by 170 scientists from Federal, State, and industrial organizations, plus representatives from Canada, France, England, and Venezuela. The meeting, under the chairmanship of USDA Eastern Utilization Research and Development Division, was devoted to recent advances in tobacco chemistry.

Milk Concentrates Conference--A conference on milk concentrates--attended by some 200--was sponsored by the Eastern Utilization Research and Development Division, the Evaporated Milk Association, the American Dry Milk Institute, and the Illinois Agricultural Experiment Station. These meetings contribute much toward keeping all segments fully informed of technologic developments so that early advantage can be taken of new knowledge.

Special Exhibits

As a part of the observance of the 100th Anniversary of the U. S. Department of Agriculture, "Open House" was held at the various UR&D laboratories. The public was given a special opportunity to observe examples of research accomplishments, inspect the research facilities, and discuss special interests with UR&D personnel. Although this year's "open house" celebrated a special occasion, the holding of "open house" is by no means new. For the past several years it has been an annual affair to invite the local and regional people to visit these installations. Interest is very high, questions are numerous, audiences are keenly appreciative of our efforts to broaden the uses of farm commodities.

National Meeting of American Association of Textile Chemists and Colorists, Buffalo, New York--(a) New and improved cotton finishes, especially for wash-wear purposes, and (b) an exhibit depicting the WURLAN treatment to impart permanent shrink-resistance to wool fabrics.

Farm Materials Handling Day, Peoria, Illinois--Industrial uses for cereal grains and especially depicting the research on high-amylose corn products.

USDA Exhibit at the U. S. Trade Center, London, England--Samples of soybean products particularly suitable for export purposes.

Annual Meeting of Northwest Cannery and Freezers Association, Seattle, Washington--Display of fruit and vegetable product and process development principally concerning frozen and dehydrofrozen products.

III COOPERATIVE RESEARCH WITH OTHER ORGANIZATIONS

Cooperative research with outside scientific groups--industry, State Experiment Stations, academic institutions, and other Federal Agencies--assures sound evaluation of newly-developed products and processes, keeps a sharp focus on new needs of consumers, and offers a rich source of ideas for solving research problems. The advantages of such cooperative efforts are typically illustrated below.

Improved Cotton Batting -- Research conducted by the Department, in cooperation with the National Cotton Batting Institute, Textile Waste Association, National Cottonseed Products Association, and the Foundation for Cotton Research and Education (affiliated with the National Cotton Council of America), is leading to improvements in the bulk resilience and cohesion of cotton batts so they can better meet the serious competition from polyurethane foams and foam rubber in mattresses and other padding applications in the furniture and automobile industries.

Cooperative Research with the Quartermaster Corps -- A cotton technologist from the Department's Southern Division is stationed at the Quartermaster Research and Development Command, U. S. Army, Natick, Massachusetts, to assist in conducting a program of cotton research, both chemical and mechanical, on the application of Department textile research findings to military uses. This research scientist has responsibility for seeing that developments of the Southern Division, and other UR Divisions as requested, are fully evaluated in military applications to meet their functional requirements, and for translating military textile requirements into terms that will enable Department research personnel to take them into cognizance in their own research programs.

Institutional Market Test on Precooked, Dehydrated Sweetpotato Flakes -- The Agricultural Research Service, Economic Research Service, Louisiana Sweet Potato Commission, the Louisiana State Agricultural Experiment Station, the Louisiana State Department of Agriculture, and the Red Star Yeast and Products Company have cooperatively conducted an institutional market test on the new "instant" sweetpotato flake product, developed by USDA Utilization Research. This market study revealed high acceptance of and good market potential for this convenience-in-use product.

Citrus Powders by "Foam-Mat" Drying Process -- In cooperation with the Florida Citrus Commission, Department research at the U. S. Fruit and Vegetable Products Laboratory, Winter Haven, Florida, is directed toward commercial adaptation of the Western Division's newly developed "foam-mat" drying process for production of high quality, "instant" citrus powders that readily reconstitute with cold water.

New Export Market for Frozen Red Tart Cherries -- The Department has cooperated with the Great Lakes Cherry Growers Cooperative, Inc. by supplying technical assistance in processing frozen red tart cherries for export. A Department scientist provided technical information on the commercial utilization of red tart cherries obtained during a visit to potential customers in seven Western European countries during March of 1962, in which it was determined that a new type of pack was required for export. This was the first effort by the United States red tart cherry industry to market frozen cherries in Europe. Results to date indicate considerable promise for the development of a substantial export market.

Cooperative Work on Cancer -- In cooperation with the Cancer Chemotherapy National Service Center of the National Institutes of Health, the plant extracts and fractions thereof obtained in the USDA new crops screening program are evaluated for antitumor activity. Select materials derived by the Department's fermentation research program that might have possibilities in this field are also submitted for evaluation.

New Fire-Fighting Agents from Cereal Grains -- A cooperative study is now in progress with the Forest Service, Pacific Southwest Experiment Station, on the use of microbial polysaccharide gums derived from agricultural raw materials as fire-fighting agents. The viscosity stability of water solutions to temperature and salts has indicated possibilities of utilizing chemical derivatives of cereal grains in this important and urgently needed market.

Wheat Bulgur Wafers for Fallout Shelters -- Wheat bulgur wafers, developed earlier in an investigation supported by funds transferred from the Office of Civil and Defense Mobilization, have now been accepted by the Office of Civil Defense, Department of Defense, as the preferred shelter ration for civilian fallout shelters. Agriculture scientists and engineers have assisted DOD personnel in drawing up procurement specifications for the product and given technical assistance to industry to facilitate procurement activities. The projected program of the Office of Civil Defense calls for a fallout shelter supply of about one billion pounds of food.

Commercialization of WURLAN Treated Wool -- Cooperative investigations have been carried out by the Department's scientists to bring to commercial practice the recently-developed interfacial polymerization process, known as "WURLAN," which makes wool shrink- and muss-resistant. Technical personnel from major textile companies have visited the Western Regional Research Laboratory for detailed discussions and demonstrations, and Department scientists have helped conduct cooperative trials under mill production conditions which have resulted in development of a practical, economical, and continuous process. Nearly all major wool textile companies, representing 70 to 80 percent of the domestic production, are working actively with this new WURLAN process and have evaluated the quality of textiles produced. It is expected that within a few months several of these companies will commence commercial operations.

IV PROGRAM MODIFICATION TO MEET CHANGING NEEDS

Planning

Utilization research planning is a continuously changing pattern of finding efficient ways to convert imaginative ideas to tangible, economic products and processes through coordinated scientific studies. This research planning has the benefit of the advice and cooperation of many organizations and individuals both within and outside the Department of Agriculture.

Committee on Agricultural Science -- A 15-member advisory group of outstanding professional personnel, consisting of 10 chemical and biological scientists and 5 economists, that reviews, evaluates, and makes recommendations concerning USDA research in related basic sciences. This committee was appointed by the Secretary of Agriculture in April 1962 upon recommendations made by the President's Science Advisory Committee. These eminent scientists represent such disciplines as genetics, microbiology, ecology, nutrition, physiology, entomology, engineering, biochemistry, physics, rural sociology, marketing, and economics.

USDA National Agricultural Research Advisory Committee -- An advisory committee composed of 11 members, with broad national interests in all phases of agriculture, that evaluates the Department's entire research program and offers suggestions for modifications, additions, and deletions. This committee, meeting quarterly, is concerned with policy matters concerning areas of research more than research methodology.

Commodity and Functional Advisory Committees -- Twenty-four commodity and functional advisory committees serve in specific fields of interest in support of the operations of the National Agricultural Research Advisory Committee. These committees meet at least once each year, with some meetings scheduled at research installations to permit first-hand knowledge of the research work.

State Agricultural Experiment Stations -- The Directors and designated technical collaborators of the State Agricultural Experiment Stations, in the respective four national regions, assist in planning research activities of mutual interest to the Federal and State groups. Much of this planning leads to cooperative research efforts, through memoranda of understanding, with considerable savings in time and money.

Agricultural Trade Associations -- Recognized national and regional groups of growers, processors, handlers, carriers, and distributors are constant sources of advice on broad needs as well as concerning problems of immediate urgency.

Product and Process Evaluation Staff -- A permanent Staff group of the Administrator's office, ARS, composed of scientists, engineers, and economists, assists in evaluating the commercial feasibility and general appropriateness of proposed utilization research projects.

Consultants -- Some 40 experts retained on a "when actually employed" basis who are recognized authorities in particular fields of interest; these people render ready-made technical and economic advice to assist in program planning and evaluation.

Consumer Groups -- Representative consumer groups of national and regional scope afford sound guidelines for research planning through their evaluations of product performance and indications of product needs. The Economic Research Service and the Agricultural Marketing Service of USDA give particular assistance through market studies, information on market trends, and consumer evaluation of new UR-developed products and processes.

Program Modifications

The Utilization Research and Development program is continuously appraised and reviewed (1) to determine fruitfulness of the research efforts, (2) to discontinue investigations that have reached the point of optimum return or appear unrewarding of useful results, and (3) to intensify research, either by reduction of effort on projects of lesser importance or by new resources when available, in areas showing substantial promise and to direct research efforts to meet new needs. Examples of such redirection of research efforts are given below.

Increased emphasis was placed on "cereal pulps" to develop paper products containing a high percentage of cereal flours, millfeeds, and starch, by transfer of personnel from discontinued work on structural material from wheat and hydroxymethylfurfural from starch.

Increased emphasis was placed on the development of a process for the mass production of spore dust from bacteria that are pathogenic to Japanese beetles for use as a biological insecticide, by transferring scientists from basic and exploratory studies on other cereal grain fermentation problems.

Research was undertaken on the development of edible, bland, and stable beverage-type protein foods from wheat designed especially for children in depressed areas; these studies were made possible by allocation of resources, on a 1-year basis, from the Administrator's Contingency Fund.

Investigations on new wheat food products, including instant bulgur, peeled wheat, and others, were initiated with funds provided by the Farmers Co-Operative Commission Co., a growers' marketing cooperative.

Investigations on processing of forages by both wet extraction and dry air classification methods were initiated with funds provided by the Nebraska Department of Agriculture and Inspection.

The objectives of research to develop winter-weight cotton fabrics on the cotton processing system were essentially accomplished, and released personnel to work on development of cotton stretch yarns and fabrics for clothing, household, and industrial uses.

With the successful completion of research to improve the light and weathering resistance of flame-resistant cotton products, resources became available to initiate new research for the development of stretchable cotton fabrics by slack mercerization.

Initiation of exploratory investigations of methods for imparting durable luster and related appearance characteristics to cotton textiles, was made possible by use of personnel reassigned from less urgent work on fundamental studies of thermoplastic cottons and exploratory research on chemical pretreatments of cotton.

Allocation of funds from the Administrator's Contingency Fund made possible the strengthening of basic research on the characterization of the constituents of dry beans.

Research on the effects of processing operations upon the texture of frozen vegetables was initiated through the financial support of the National Association of Frozen Food Packers.

Increased emphasis on the development of foreign-type, high-protein foods from soybeans to increase export outlets was made possible by discontinuing research to develop adhesives from soy flour.

Engineering studies on development of a process for making bland oil and meal from mustard seed were successfully completed, and personnel reassigned to processing studies on Crambe abyssinica, a new oilseed that shows promise for a new crop.

Research was discontinued on isolated egg components and study of their in situ state with respect to protein characteristics related to the useful properties of eggs, and the released resources shifted to applied studies on instant egg powders.

The successful completion of studies on the composition of the basement membrane of cattlehides has released funds for the initiation of investigations on the non-collagenous proteins of hides and skins.

Studies on the production and properties of certain copolymers of octadecyl acrylate were completed, and the released resources made possible the initiation of research on polymerizable fatty amides directed to development of new products from animal fats.

New Research Initiated with Increased Appropriations

Additional research was made possible by an increase of \$600,000 in appropriated funds in F. Y. 1962.

Basic and exploratory research was expanded to develop new starch products by new chemical modifications and processes.

Research was undertaken to develop new wheat flour products for industrial use through chemical and enzymic modifications, and to evaluate their use as paper sizes, coating adhesives, and wet-strength additives.

Research was intensified on the nature and extent of interactions among wheat proteins and on the chemical groupings and bondings responsible for the unique cohesiveness of wheat gluten proteins, to provide the information needed for the development of new and improved products from wheat.

Research was initiated to investigate the mechanisms by which improved dry and wet crease recoveries are produced in cotton fabric, and to find ways by which these mechanisms can be modified to produce improved wash-wear cotton products.

Basic studies were extended on the composition of essential citrus oils, with special emphasis on essential orange oil, as related to flavor of juices, concentrates, powdered juice, and other citrus products.

Exploratory investigations were initiated to study ways of chemically modifying linseed oil to produce derivatives suitable for use in making water-soluble paint vehicles.

Additional funds enabled the initiation of new work on the aromatic constituents of cigarette smoke to correlate the composition of smoke with the components found in cigarette leaf tobaccos.

Utilization Research Projects Terminated

A total of 89 research projects were terminated in F. Y. 1962 for the following reasons.

Research objectives attained	48
Research objectives partially attained	13
Research results unpromising or superseded by research of higher priority ..	18
Exploratory research completed to define specific phases of a problem	10
Total Terminated	89

Utilization Research Projects Initiated or Revised

One hundred thirty-three utilization research projects were initiated or revised in F. Y. 1962. Of these 133, new domestic projects totaled 95, with 38 new projects being placed in foreign laboratories.

COMMODITY	INDUSTRIAL USES	FOOD USES	FEED USES	TOTAL
Cereal grains and forages	24	10	4	38
Cotton and wool	24	--	--	24
Fruits and vegetables	--	15	--	15
Oilseeds	8	9	3	20
New and special crops	12	--	--	12
Poultry, dairy, and animal products..	9	15	--	24
	77	49	7	133

Summary of Utilization Research Projects for F. Y. 1962

Type	Active at Begin- ning F. Y. 1962	Initiated or Revised	Terminated	Active at End F. Y. 1962
Domestic	299	95	88	306*
Foreign	73	38	1	110
Total	372	133	89	416

*Consists of 231 "in house" projects of which 33 are directly supported by industry (fellowships), 69 domestic contracts, and 6 supported by funds transferred from other Federal Agencies.

V CURRENT UTILIZATION RESEARCH PROGRAM

The Utilization Research and Development program is conducted in four regional and ten associated field laboratories in this country (920 scientific and technical personnel as of July 1, 1962); in various domestic laboratories under research contracts; and in laboratories of fourteen foreign countries supported by P. L. 480 funds. This program encompasses a broadening base of fundamental studies, engineering investigations including pilot plant work for converting laboratory findings to practical commercial applications, and pharmacological evaluations to assure safe usage.

Present principal research areas -- including both domestic and foreign laboratories -- are as follows.

Cereal Grains and Forages -- Major part of the research effort is devoted to corn and wheat, plus continuing investigations on rice, barley, oats, sorghum, and alfalfa and other forages.

Development of processes for chemically modifying starches, flours, and whole-grain cereals to make "cereal pulp" for use in paper products.

Development of new and improved starch derivatives for use in water-resistant adhesives and coatings, foamed products, and high-wet-strength papers.

Ascertaining economic uses for high amylose starch chemicals and intermediates as textile sizings, protective films, fibers, and paper additives.

Development of commercial uses for dialdehyde starch derivatives, particularly leather-tanning and paper making.

Finding new food and industrial uses for wheat gluten.

Development of biological pesticides including insecticides for Japanese beetles, insect attractants, and plant antibiotics.

Development of new and improved food uses for wheat, with increasing emphasis on products designed to meet specific needs of foreign markets.

Development of new cereal products suitable for civilian emergency uses.

Development of new and improved rice processing techniques and rice food products.

Upgrading of processed cereal grain feeds based upon comprehensive characterization and chemical modification of constituents.

Development of new and improved feed products, such as forage juice concentrates and air-classified products, and studies of biologically active constituents of forage products.

Cotton and Wool -- Chemical, physical, and mechanical processing research on cotton and wool, and supporting fundamental and exploratory studies of their fiber properties and their modification.

Fundamental and applied studies to improve wash-wear cotton fibers and fabrics.

Development of stretch and bulky cotton products and processes.

Development of expanded uses for flame-retardant cotton products.

Chemical modification of cotton to simultaneously impart durable water and oil repellency.

Development of commercially feasible weather- and rot-resistance finishes for cotton.

Improved cotton processing equipment for blending, for weaving, and for removing short fibers.

Commercial adaptation of easy-care wool processes (non-shrinking, permanent creases, etc.).

Development of new types of yarns and fabrics through physical and chemical modification of the coarser grades of domestic wools.

Chemical modification of wool to improve resistance to acids and alkalis and to minimize carbonizing, bleaching, heat, and light damage.

Fruits and Vegetables -- Research to develop fruit and vegetable products that are attractive, economical, nutritive and meet the increasing demand for convenience-in-use, and to develop processes and equipment for manufacture of these products.

Development of foam-mat drying techniques and equipment for dehydrating fruit and vegetable juices, sauces, purees, and other products.

Development of improved dehydration techniques, including dry-blanch-dry and puff-drying processes, for producing better quality dried fruit and vegetable products, particularly with superior reconstitution properties and retention of original flavor and color properties.

Improved processes for freezing, dehydrofreezing, and dehydrocanning of fruit and vegetable products.

Commercial adaptation of the UR process for producing dehydrated sweetpotato flakes.

Investigations for improving texture, color, and stability of fermented vegetable products.

Development of new citrus, deciduous fruit, and vegetable products that afford greater economy, increased flavor, longer storage life, and more convenience-in-use than present commercial products.

Studies to determine the processing qualities of new varieties of fruits, berries, and vegetables.

Oilseeds -- Research primarily on soybean, cottonseed, and linseed oils, meals, and related products; investigations also include castor, tung, and selected oilseeds resulting from the new crops screening program. Research stresses new and broadened industrial uses, and seeks to improve food and feed uses.

Process research, stressing flavor stabilization through selective hydrogenation, to improve soybean oil for edible purposes, and development of aldehyde acids and other derivatives for industrial utilization of soybean oils.

Development of feed, food, and industrial uses for soybean meal and protein.

Development of processes to improve color and edible qualities of cottonseed oil, and to enhance feeding value of cottonseed meal.

Process and product development utilizing chemically modified monoglycerides from vegetable oils, especially from cottonseed.

Development of linseed oil derivatives suitable for use in emulsion paints for exterior surfaces, in water-soluble paints, and as industrial chemicals.

Development of industrial chemical derivatives, urethane foams, and animal feed meals from castorseed, plus basic and applied studies for removal of allergenic constituents.

Investigations to improve flavor and stability, and to achieve desired nutritional properties in peanut-containing food products.

Development of new industrial materials from tung oil, with special emphasis on uses in intumescent fire-protectant paints.

New and Special Plants -- Investigations directed to develop compositional data on plants from world-wide sources in an effort to find alternate crops to fill needs not now met by domestic sources, and to develop new and more economic uses for domestic special plants.

Research on industrial utilization of new oilseeds, particularly on the processing of erucic, epoxy, petroselenic, and hydroxyconjugated dienoic acid oils, and the development of chemical derivatives from these sources.

Research on new gum and pulping fiber plants, especially those containing mucilaginous materials and those suitable for use in paper, structural, and related products.

Chemical composition studies of tobacco and tobacco smoke to assist industry in its search for desired qualities in tobacco products.

Improvement of techniques for the processing of sugarcane, sugarbeet, and maple sap, and development of new uses for honey.

Development of new industrial chemicals from pine gum, turpentine, and rosin.

Poultry, Dairy, and Animal Products -- Development of better and more economic food products from milk, poultry, eggs, and meat, and development of new industrial outlets for fats, hides, and other animal byproducts.

Improvement of products made from meat and poultry, and improvement of processing methods based upon fundamental studies of flavor, tenderness, microbiological activity, and time-temperature-tolerance stability.

Research on milk products including studies of flavor stability, fermentative processes, concentrated and dried milk products, removal of radionuclides, and cheese-making technology.

Development of new uses for animal fats in improved polymers, plastics, and resins; in new types of lubricants; in specialty synthetic detergents; and as industrial chemical intermediates.

Research to increase use of animal hides stressing development of new techniques for unhairing, new processes for imparting improved resistance of leather to deterioration by heat and perspiration, and new and improved tanning procedures.

Investigations to increase usefulness of dried egg products in dry mixes and other convenience foods; to make readily dispersible egg solids; to devise better methods for control of Salmonella in egg products.

VI FINANCIAL INFORMATION

The F. Y. 1962 and F. Y. 1963 domestic Utilization Research and Development funds under "Salaries and Expenses, Agricultural Research Service," including allotments from the Special Fund for additional labor, are as follows.

	<u>F.Y. 1962</u> (Obligations)	<u>F.Y. 1963</u> (Estimated)
Cereal and forage crops	\$ 4,009,725	\$ 5,231,000
Cotton, wool and other fibers	3,882,858	4,941,000
Fruits and vegetables	2,887,299	3,557,000
Oilseeds	2,128,832	2,815,000
New and special plants	1,719,464	1,944,000
Poultry, dairy, and animal products	<u>3,952,797</u>	<u>5,280,000</u>
Total	<u>\$18,580,975</u>	<u>\$23,768,000</u> a/

a/ Excludes \$637,700 for estimated pay costs pursuant to Public Law 87-793.

In F. Y. 1962 Congress provided an increase of \$600,000 which has been distributed as follows:

<u>Cereal and forage crops</u>	
Research to increase industrial and food uses of wheat and corn	\$ 300,000
<u>Cotton, wool and other fibers</u>	
Basic research on cotton	100,000
<u>Fruits and vegetables</u>	
Basic research on flavor constituents and development of new citrus products	75,000
<u>Oilseeds</u>	
Research on linseed oil products	25,000
<u>New and special plants</u>	
Basic compositional studies on tobacco	100,000
Total	<u>\$ 600,000</u>

In addition to the above funds appropriated for F.Y. 1962, the following amounts were obligated from the Contingency Research Fund, on a one-year basis, as follows.

<u>Cereal and forage crops</u>	
Development of protein-rich preparations from wheat	\$ 99,436
<u>Fruits and vegetables</u>	
Determination of flatulence constituents in processed dry beans	45,289

Oilseeds

Purchase of equipment for research on inactivation of cyclopropene acids in cottonseed products	\$ 18,865
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Poultry, dairy and animal products

Purchase of a centrifuge and pilot plant equipment for research on removal of strontium-90 from milk	42,589
Total	<u>\$ 206,179</u>

The F.Y. 1963 appropriations include an increase of \$4,975,000 provided by Congress which has been distributed as follows.

Cereal and forage crops

Corn	\$540,000	
Grain sorghum	60,000	
Wheat	550,000	
Forage	<u>50,000</u>	\$1,200,000

Cotton, wool and other fibers

Cotton	\$750,000	
Wool	<u>200,000</u>	\$ 950,000

Fruits and vegetables.

Fruits	\$375,000	
Vegetables	<u>300,000</u>	\$ 675,000

Oilseeds

Soybean	\$350,000	
Flaxseed	50,000	
Cottonseed	100,000	
Peanut	100,000	
Castorbean	<u>50,000</u>	\$ 650,000

New and special plants

New crops	\$100,000	
Tobacco	<u>100,000</u>	\$ 200,000

Poultry, dairy and animal products

Poultry products	\$200,000	
Dairy products	400,000	
Meat products	400,000	
Hides and leather	200,000	
Animal fats (inedible)	<u>100,000</u>	\$1,300,000
Total F.Y. 1963 increase		<u>\$4,975,000</u>

In addition to the domestic Utilization Research and Development program, approximately \$2.41 million was obligated in F.Y. 1962 for utilization research projects, largely extending over a five-year period, in foreign laboratories financed by funds generated under the P. L. 480 program.

VII SELECTED RESEARCH ACCOMPLISHMENTS

Experimental Paper Made with Cereal Xanthide -- Using the process developed by the Department, it has been possible to successfully produce paper containing cereal xanthides on a high-speed pilot-size paper machine. The water-insoluble cereal xanthides are produced by treating flours, starches, or ground whole-grain cereals with readily available, low-priced chemicals. Linerboard paper for corrugated paper boxes exhibited improved crush resistance under moist conditions, which is a major deficiency in conventional corrugated boxes. Bag paper containing 20 percent cereal xanthide exhibited superior wet and dry strength. Greaseproof paper containing 40 to 50 percent cereal xanthide showed improved properties over conventional greaseproof paper. Other applications are being developed. Conservative estimates indicate that the rapidly expanding paper products industry--now producing more than 35 million tons annually--could utilize cereal xanthides using over 100 million bushels of cereal grains per year.

New Bulgur Process Aids Wheat Exports -- The stability, whole-grain nutritive value, and adaptability to widely diverse food customs make bulgur (parboiled wheat) an ideal product to broaden world markets for U. S. wheats. Continuing Department research on the processing of wheat into bulgur has resulted in the development of a new, continuous process which operates at atmospheric pressure. Economical in heat and labor requirements and employing conventional, readily-available equipment, the process can be set up for any desired scale of production. A large midwestern grain company is constructing a bulgur plant based on this process, while other companies are converting existing equipment. Rapid expansion of facilities for bulgur production has been stimulated by the outstanding success of last year's experimental export program involving 60 million pounds of bulgur. The large potential market that exists for this product is indicated by plans for at least a five-fold expansion of exports this year. This will move over 300 million pounds of bulgur into school lunch and other market-building programs abroad.

High-Amylose Starch -- USDA utilization research has shown that the properties of the high-amylose starch make it uniquely suitable for specialty uses in the glass fiber, paper, and packaging industries. A number of manufacturers are evaluating this new starch product for these and other possible industrial uses. Corn with starch containing over 60 percent amylose is now grown commercially as a result of Department-State Experiment Station-Industry cooperative development. Prospects are good for producing corn with starch containing 70 to 80 percent amylose within 5 years (ordinary corn starch contains 27 percent amylose). Two major corn wet-milling companies are having the 60-percent-amylose corn grown under contract in 1962.

Relating Wheat Flour Composition to Baking Characteristics -- Fundamental knowledge on the relationship of flour constituents and baking functionality of wheat flour has been advanced in research conducted in France under a USDA P. L. 480 grant. In this baking study, an interconnected rôle of lipid composition of flour with the protein-functionality relationship is being elucidated. Already there has been shown a protein-lipid correlation with the sedimentation value (an empirical test widely used to evaluate baking quality of wheat). The studies have also shown that the amount of phosphorous-containing lipids extracted by ether from different wheat samples also varies in a parallel relationship to the baking characteristics of the flour.

Improved Corn Oil Recovery -- Through a study of the present corn dry-milling process, the Department's research engineers have demonstrated that corn oil recovery per bushel of corn milled could be increased as much as 50 percent by changes in processing conditions. This improvement is important to the use of 100 million bushels of corn processed by dry millers each year, which yields about 50 million pounds of corn oil. These modifications have now been installed by one of the largest millers and are under consideration by others.

New Resins Made from Corn Sugar -- Chemically modified corn sugar has been converted into three new types of resins having unique properties not available in synthetic polymers made from petrochemicals. The new polymers can be formed into films, fibers, and plastics. Industrial interest centers around modification of existing commercial polymers by mixing or interacting the new polymers to impart needed properties to increase utility. Several industrial companies are investigating these possibilities. This research was carried out in the United Kingdom under a P. L. 480 grant.

Improved Stability of Dehydrated Alfalfa Opens Export Markets -- The discovery by Department scientists that ethoxyquin effectively preserves carotene, xanthophylls, and vitamin E in dehydrated forages has resulted in the creation of an important, growing export market for dehydrated alfalfa. After stabilization with ethoxyquin, dehydrated alfalfa serves as an excellent source of the xanthophylls needed to produce the yellow-skinned poultry so highly desired by consumers in Japan and Central Europe. Only a few years ago, prior to the development and adoption of the stabilizing treatment, essentially no dehydrated forage was exported, but this year 200,000 tons (requiring over 40,000 acres for its production) were sold abroad. This is in addition to domestic uses of the ethoxyquin treatment which include 90 percent of over a million tons of dehydrated forage produced annually and 10 million tons of poultry feed so treated to preserve vitamin E. Vitamin E and ethoxyquin are mutually effective in preventing the occurrence of crazy chick disease.

More Economical Process for Beta-Carotene Production -- The Department previously had developed a fermentation process for producing beta-carotene from a culture medium largely of agricultural origin. More recently, the process was improved by replacing an expensive synthetic chemical, which had been considered an essential ingredient of the fermentation medium, with citrus pulp or citrus molasses, which are inexpensive byproducts from the citrus juice industry. The improved process is being evaluated by at least six major companies. It is estimated that the cost of beta-carotene produced by this fermentation process will be less than half the cost of the synthetic product. Beta-carotene is a precursor of Vitamin A, an important supplement for foods and feeds. Another use for beta-carotene is as a coloring agent for margarine, beverages, and oil for popping corn.

Dimethylol Monocarbamate Finishes for Wash-Wear Cottons -- A new class of agents, dimethylol monocarbamates, for imparting wrinkle-resistance and wash-wear properties to cotton fabrics has been developed. These finishes are equivalent in most respects to the non-nitrogenous finishes now in use. Thus the advantages of relatively low cost, convenience, high efficiency, and minimum fabric damage of the nitrogenous agents may be utilized without the usual disadvantages. Two industrial concerns are promoting the use of dimethylol ethyl carbamate, and evaluation of the process by several finishers is currently being carried out. Additional agents of this general class are being investigated by USDA scientists to determine their suitability for commercial use.

Polyfunctional Cotton Finishes Derived from Divinyl Sulfone -- New adducts of divinyl sulfone with compounds such as formaldehyde, long chain alcohols, perfluoroalcohols, and glycerol, when applied to cotton improve such properties as crease recovery and water repellency without excessive loss in fabric strength. Adducts with starch and polyvinyl alcohol impart durable stiffening together with wash-wear properties. Especially promising from a practical standpoint is bis(2-hydroxyethyl) sulfone, a commercially available and inexpensive chemical which has been used to attach dyes, starch and other compounds to cotton while simultaneously crosslinking it. Two commercial concerns are now producing or employing cotton textile finishing agents containing derivatives of divinyl sulfone.

SRRL Ringless Spinning Machine -- A new type machine, called the SRRL Ringless Spinning Machine, for spinning cotton yarns without the conventional ring and traveler system has been developed in Department research. The machine winds the yarn directly from the spinning spindle into packages of any shape or size needed for later processing steps, thus eliminating the time and labor required in conventional ring spinning to change bobbins and rewind the yarn. Experimental high twist, medium coarse yarns have been spun at a production rate equal to that of standard spinning frames. The

experimental work is now complete and the research results have been released to the textile industry. One of the large manufacturers of textile machinery in the United States is currently making a technical and economic evaluation of the experimental model machine.

New Basic Information on Oxidative Degradation of Cotton -- Basic investigations conducted under grant of P. L. 480 funds to the Ministry of Commerce and Industry, of the State of Israel, have yielded information which explains the mechanism of the degradation of cotton which occurs during bleaching with sodium hypochlorite and hydrogen peroxide. The results indicate that oxidation and the resulting breakdown is random, and involves cleavage of the cellulose polymer chain, followed by oxidative attack at the points of cleavage. This more detailed knowledge of the mode of action of commercial bleaching agents should lead to improvements in their application and in the finished textiles produced.

Chemical Treatment Protects Wool Against Yellowing by Light -- Research has clarified the hitherto mystifying, contradictory effects of sunlight upon wool color. USDA scientists have shown the effects of the different ranges of the ultraviolet light from sunlight upon the color of wool. This new knowledge is assisting scientists to develop chemicals which, when incorporated into wool, protect it from various ranges of ultraviolet light. Already one such chemical (butyl-benzoyl-methoxy-phenol-sulfonate) has been discovered which exerts a powerful protection against yellowing by light. This discovery is highly significant because premium prices are now paid for white wools, since these can be dyed to light pastel shades which are in great demand. The advent of pure white synthetic fibers has further emphasized the demand for white wools that stay white during the lifetime of the fabric.

Linseed Oil Emulsion Paints in Commercial Production -- As a result of the Department's cooperative research with the flaxseed industry, over 50 paint manufacturers are making linseed oil emulsion paints-- a new type of paint superior in many properties to the synthetic resin paints that have been replacing conventional protective coating products. If the current consumer acceptance of linseed oil emulsion paints continues, the decline in paint use of linseed oil should be halted and lost markets may be regained.

Linseed Oil Protects Concrete Roadways -- The Department is cooperating with the National Flaxseed Processors Association in determining the value of a thin coating of linseed oil for the protection of concrete highways and bridge decks against deterioration by spalling under freeze-thaw conditions, particularly in the presence of salts. Linseed oil seals the surface of the concrete and prevents inward diffusion of water and dissolved salts which upon freezing exert a disruptive effect. There is an increasing trend towards adoption of this protective treatment on highways. The State of Illinois has

recently specified the use of linseed oil for this purpose. Country-wide adoption of this practice would greatly increase the consumption of linseed oil. For example, the potential consumption for only the Federal Road Program is around 35 million pounds of linseed oil per year. Current Department research is aimed at development of stable, easily applied water emulsions of linseed oil, to replace the solvent-thinned oil blend now being used, in order to decrease cost and to eliminate flammability, and determining the effect of linseed oil coatings on the durability of air-entrained concrete and its resistance to freeze-thaw cycles under controlled conditions.

Improved Technique for Measuring Polyunsaturates in Soybean Oil -- Department scientists have developed a new analytical technique which provides information on the amount and kind of polyunsaturated fatty acids present in hydrogenated edible soybean oil products. This information is of vital importance both in the development of edible products from soybean oil that will have optimum stability and nutritional value, and in biomedical research on atherosclerosis and essential fatty acid function. Previous methods of analysis were inadequate to characterize the complex mixtures produced.

Improved Processing of Cottonseed Meal -- Based on earlier laboratory findings which indicated that processing cottonseed with a solvent mixture of hexane-acetone-water could be employed to produce cottonseed meals of improved nutritive quality, engineering studies have been undertaken to develop such a process suitable for use on a commercial scale. Two approaches investigated on a pilot plant scale show considerable promise: (1) development of a process which would allow adaptation of existing commercial basket extraction plants to mixed solvent extraction with the minimum modification of, or use of, additional equipment, and (2) use of countercurrent continuous extraction with a vibrating screen separator. Successful adaptation of the mixed solvent process to commercial use would result in the production of meals more suitable for feeding to poultry and swine, in addition to the conventional use in feeds for cattle and other ruminant animals. Recent feeding tests have confirmed the high nutritive value of cottonseed meals produced by mixed solvent extraction.

Technological Advances in Sausage Manufacture -- Through basic research, principles and factors involved in producing meat emulsions have been resolved, and an analysis predicting the emulsifying capacity of meats has been devised. Thus, a more scientific basis has been provided for emulsion curing, the key operation in manufacturing such products as frankfurters and bologna. The method developed for determining the capacity of meat for fat-binding provides for precision and uniformity in sausage-making. Also, it can furnish part of the numerical data needed to improve the use of electronic computation of the best and most economical formulas for emulsion-based meat products.

New "Instantized" Nonfat Dry Milk -- The newly developed method of foam-spray drying has been successfully applied to the preparation of "Instant" nonfat dry milk and other dairy products. This new procedure yields a product that has essentially the same bulk density, ready dispersibility, and quality as the conventionally made "Instant" product. The new method also eliminates the conventional instantizing hydrations and re-drying steps, and has other economic advantages. The new process has attracted much interest from industry.

New Protein Isolated from Cow's Milk -- The existence of a specific "membrane" protein on the surface film of the fat globules in milk has been the subject of speculation and investigation for over 100 years. This protein was recently isolated and characterized by USDA chemists. The protein is essentially homogeneous by electrophoretic measurements, and because of its composition and properties was classified as a mucoprotein. Antigenic studies showed that it is immunologically distinct from other milk proteins. The mucoprotein proved to be one of the most potent antigens in milk - and accordingly a new, potentially significant factor in milk allergy.

Transmission of Biological Activity from Feed to Milk -- The Biochemical Institute, Helsinki, Finland, under a USDA P. L. 480 grant, has made outstanding contributions to our knowledge of the transmission of compounds related to flavor from dairy feed into milk:

- (a) Onion flavor in milk is believed to be caused by dipropyl disulfide, a metabolic product of naturally occurring sulfur compounds in plants of the onion family; this flavor concentrates in the fat fraction of milk, and is particularly noticeable in butter.
- (b) Compounds in feeds which tend to enlarge the thyroid gland were not transmitted to milk in detectable quantities, as judged by rat feeding tests, even when fed to the cow in excessive amounts; milk from cows which ingested feed containing thiocyanates was much lower in iodine content than normal milk.

Yeast from Cheese Whey -- A process has been developed for utilizing the whey byproduct from the manufacture of cheese. The billions of pounds of whey annually discarded as waste not only increase the pollution load of the nation's waterways, but constitute a loss of millions of pounds of milk sugar. Approximately 0.25 pound of protein can be produced from one pound of milk sugar. Analysis of the protein and vitamin content of the dried whey-yeast reveals similarity to levels of these components in other yeast preparations now used for nutritional purposes. The whey-yeast can be used as a protein supplement in animal feeds or for human nutrition. One company is currently using this method for yeast production and several other industrial concerns are evaluating the process.

Removal of Radionuclides from Milk -- The joint effort of the U. S. Atomic Energy Commission, the U. S. Public Health Service, and the U. S. Department of Agriculture in developing a practical procedure for removal of radionuclides, especially strontium-90 and iodine 131, from milk is progressing rapidly. It is planned to install the necessary equipment in a plant with a capacity of 100,000 pounds of milk per 8-hour day in order to evaluate the large-scale feasibility of the process. The demonstration will utilize the ion-exchange process developed in USDA laboratories at Beltsville.

Research Points Way to Better Leather -- Basic studies conducted at the British Leather Manufacturers Research Association, Egham, England, under a USDA P. L. 480 grant, have elucidated several mechanisms of leather deterioration. It has been found that leathers tanned with a combination of chrome and vegetable tannins deteriorate more rapidly because of the competition between the protein and the vegetable tannins for the covalency of chrome. This indicates that improved leathers should result from the use of chemical agents that establish stable cross links within the protein, and explains in part why resistant leathers have been produced by tanning with dialdehydes (a previous USDA development).

Better Method for Tenderizing Poultry -- Poultry to be frozen customarily is aged for six to twelve hours after slaughter in order to achieve tenderness. This holding period prevents the use of continuous processes and substantially increases the cost of poultry to the consumer. An experimental procedure has been developed by Department scientists that may completely eliminate the need for aging prior to freezing. The basic finding is that the muscle of young birds is tender without aging if normal post mortem breakdown of glycogen (animal starch) is prevented. A simple way to accomplish this is to inject birds with adrenalin 18 hours before slaughter, which completely destroys the glycogen while the bird is alive and thus eliminates the post mortem changes responsible for toughness.

Instant Whole Egg and Yolk Powders -- New and improved egg-containing convenience foods such as omelet, custard, pie filling, and drink mixes offer considerable promise for arresting the decline in the use of eggs. The development of such products has been made possible as a result of Department research. Whole egg and yolk solids that reconstitute in seconds have been experimentally produced by two new procedures: Forced air drying of foams and by spray drying of gas-impregnated liquid egg. The powders produced by the two procedures differ in density and flow characteristics and, to some extent, in performance properties. These methods will allow production of powders that are more convenient to use and that are more nearly tailor-made for a wide variety of uses in domestic and foreign markets. Further work is under way to assure microbiological safety and to fully evaluate the useful properties of the new powders.

Potential New Industrial Oilseed Crop -- Chemical screening of uncultivated plants in the Department's New Crops program has shown Crambe abyssinica to be a potential new oilseed crop. Oil from the seeds is unusually high (over 50 percent) in erucic acid--a potentially important industrial chemical which is now largely imported. Research currently indicates that Crambe oil offers possibilities for conversion into new chemicals for the manufacture of resins, plastics, fibers, and coatings. The production of Crambe abyssinica is being studied cooperatively with several State Experiment Stations. Since it apparently can be grown in the principal wheat-growing areas of Western United States and the Northern Corn Belt States, Crambe offers good possibilities for replacing some of the surplus wheat acres in those areas.

Feed Meal from Mustard Seed -- A commercially feasible process has been developed by the Department's utilization research for producing from mustard seed a bland feed meal with potential as a protein supplement in livestock feed. The new process eliminates the pungent flavoring material from the meal, and should make it acceptable to livestock as a feed. Coproducts are a bland vegetable oil, with potential uses similar to rapeseed that is currently imported, and a concentrate containing the pungent factor; there is an industrial demand for the latter product and some currently is being imported. Commercialization of this process should permit growing of mustard seed on land currently devoted to surplus crops, particularly in Montana and adjacent areas, and make possible the production of a feed meal in areas where such feed materials are urgently needed from local sources.

Improved Yields in Beet Sugar Refining -- A procedure for operation of countercurrent sugarbeet diffusion batteries has been devised which greatly reduces the concentration of deleterious salts in the diffusion juice and consequently cuts down the loss of sugar through formation of molasses. Laboratory and pilot plant studies, later confirmed in commercial operations, revealed that unwanted chlorides enter the process both as a normal constituent of the beets and as an impurity in the water supply to the diffusion battery. It was found that by introducing distilled water from the evaporators at a point near the middle of the extraction train, and adding the necessary impure water only at the tail end of the train, up to 87 percent of the salts introduced into the process in the impure water leave the train with the extracted beet pulp, and contamination of the diffusion juice is greatly reduced. Application of this new procedure will result in substantial savings as refined sugar.

New Industrial Products from Turpentine -- A practical process has been developed for making pinonic acid from alpha-pinene, the major constituent of American turpentine. Chemical derivatives of pinonic acid are useful in making premium-quality plasticizers, resins, lubricants, and other products. One commercial firm is presently going into pilot-plant scale production of pinonic acid, and other companies have expressed interest in its industrial potential. Other possible uses for this versatile material are in the fields of polymers and surface coatings.

Foam-Mat Drying Advances to Commercial Use -- Foam-mat drying, a process invented by Department engineers, has advanced to production of tomato powder under military contract and also for export trade as the first of several such commercial enterprises. Over fifty different foods have been successfully dried experimentally by this procedure. The potential economic importance of this new method of preserving liquid and pureed foods (fruit juices, juice concentrates, tomato paste, soups, and sauces) is good. Foam-mat dried products are well suited to meet two important trends for profitable utilization of domestic agricultural products: (1) convenience-in-use demanded by consumers; and (2) stability without refrigeration and economy in weight and space necessary for export markets.

New Method Controls Darkening of Apple Products -- A recent Department discovery provides a means to prevent darkening of apple slices, and should result in greatly reducing, or completely eliminating, the amount of sulfite used in preservation of apple products, thus greatly assisting in overcoming objections by many consumers, particularly in foreign markets. Studies on the natural enzymes of apples have led to the discovery of a simple inexpensive method for inactivating the surface tissue of cut slices so that enzymatic browning cannot occur. This inactivation involves temporarily modifying the natural acidity on the cut surface tissue. Such modification has no effect on taste and is completely harmless. The effects are permanent since compounds susceptible to darkening are changed enzymatically into natural constituents which do not undergo browning. This discovery promises to overcome the perplexing problem of darkening of cut apples and apple juice.

Progress in Flavor Research -- Study of volatile compounds related to food flavor has been significantly advanced with the introduction of the "aromagram" method. With this new technique the extremely dilute concentrations of aromatic fruit and vegetable flavors, especially as they exist over very small samples of food, can be separated and identified. Until recently, most flavor studies required the extraction and concentration of flavor constituents from many tons of the original fruit, vegetable, or other food commodity. Such laborious extraction and concentration oftentimes allow chemical changes to take place and interfering substances to enter into the study. By these new techniques, many compounds can now be found and studied without complications caused by the presence of these artifacts.



